FURTHER EXPERIENCES IN SACRAL ANESTHESIA IN UROLOGY *

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The anatomic structure of the sacrum, in which all the lateral foramina communicate with the main central canal, favors the distribution of fluid introduced through any of the openings. The sacrum is covered only by a thin layer of subcutaneous tissue and the openings are readily located by means of prominent landmarks and in most cases are easily entered.

There are two common methods of anesthetizing the sacral nerves, one by merely injecting novocain solution into the main central canal through the caudal foramen, and the other by individual injection of each nerve as it leaves the lateral sacral foramen. The caudal injection is satisfactory for most operations on the perineum or external genitalia, and for practically all endovesical procedures. After making a single caudal injection it is necessary to wait twenty minutes before complete anesthesia occurs. It has the further disadvantage of failing to induce complete anesthesia in from 10 to 15 per cent of the cases. If the lateral nerves are injected individually there is an almost immediate anesthesia of the area involved and failures are unusual. It is much more difficult to inject the nerves as they leave the canal than to make the single caudal injection, and the contact of the needle against the periosteum, or the occasional striking of the nerve, causes the patient pain.

Both methods of injection are best carried out with the patient lying on his abdomen. The caudal injection is a suitable office procedure; it incapacitates the patient only during the period of the examination, and is generally not suited for extensive cutting operations. The anesthesia varies in duration; the period of maximal intensity in most cases is about sixty minutes. The patient is placed on the table face downward, the dorsal and lumbar spine is slightly elevated above the sacrum so that the injected fluid will remain in the region of the sacral nerves. The sacral hiatus is located at the lower end of the sacrum as an elastic depression at the sacrococcygeal joint. In most cases it is triangular in shape; the lower two angles are bounded by the cornu of the incompletely fused fifth sacral vertebra. The skin is anesthetized over the ligament, a thin spinal needle held at right angles to the skin is then inserted through the skin and ligaments (Fig. 1). A definite crunch is felt as the needle passes through the ligament. The point of the needle is then directed up the canal which it should enter readily. The needle may strike the lateral wall or the point may become buried beneath the periosteum; slight withdrawal and redirection of the point will in most cases permit insertion for a sufficient distance, about two to four cm. It is possible to enter most canals, although occasionally an ossified membrane is encountered. In some instances the canal cannot be located, or the anterior posterior diameter is too small to permit the entrance of the needle. Not infrequently the needle enters one of the sacral veins and on withdrawal of the stylet a few drops of blood appear. The needle should then be partially withdrawn and the point redirected. If blood flows freely from the needle, the injection should be abandoned; if a portion of the injected solution is absorbed through a tear or large puncture in the vein, symptoms of toxemia are likely to appear immediately and the resulting anesthesia will be unsatisfactory.

There is always the possibility that the needle will enter the dural sac, and this will be indicated by the appearance of spinal fluid when the stylet is withdrawn from the needle (Figs. 2 and 3). The needle is generally inserted only two or three cm. and it is only in the exceptional case that

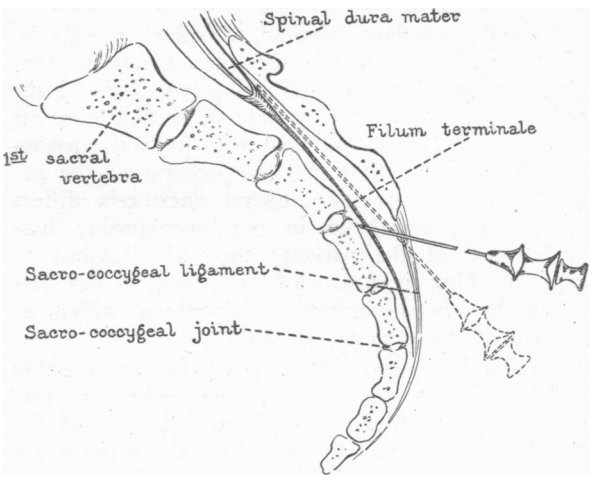

Fig. 1
Section through sacrum, showing relation of needle to sacral canal and dural sac.

the dural sac reaches to within four or five cm. of the sacral ligament. In one case the dural sac was punctured after the needle had entered the canal only two cm. If spinal fluid appears, the needle should be withdrawn until the flow stops before the injection is made.

Novocain solution is prepared fresh for each case. Thirty cubic centimeters of a 2 per cent solution of novocain bicarbonate solution is used in most cases. In children, or in adults with reduced vitality, the dose is diminished. The most satisfactory results have been obtained from Metz novocain; it is kept in powders with enough soda bicarbonate to make 30 cc. of a 2 per cent solution; sodium bicarbonate 0.15 gm., sodium chloride 0.1 gm., and novocain 0.6 gm. The powders will remain fresh for from ten to twelve days, after which they lose strength, and when injected may cause mild symptoms of toxemia. As suggested by Brock of the Mayo Foundation, if the novocain is kept separated from the bicarbonate until ready for use the powders do not deteriorate so readily.

The addition of sodium bicarbonate to novocain gives a solution which diffuses more readily through the nerve sheaths; the anesthesia is generally of a greater intensity, and the possibility of

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a failure is less than when novocain alone is used. The powder is dropped into 30 cc. of boiling distilled water and the solution removed from the flame. After the solution cools several drops of 1:1000 epinephrin are added. In certain cases the epinephrin produces a mild reaction; the patient complains of a feeling of suffocation and increased heart action. On this account only small amounts of epinephrin are added. The solution should be injected slowly, three or four minutes being taken for the injection of 33 cc. The fluid should meet with little resistance; if force is required, the needle probably is not in the open sacral canal and should be readjusted. After the injection the patient assumes the sitting posture in order to retain the fluid in the sacrum. Anesthesia of the sacral nerves first appears in about ten minutes and reaches its maximal intensity in from twenty to thirty minutes.

Caudal injections, similar to spinal anesthesia, give complete relaxation of the structures supplied by sacral nerves. There is paralysis of the reflex arc, causing muscular relaxation that is greater than can be obtained with general anesthesia; at the same time the co-operation of the patient may be obtained. Sacral anesthesia differs from spinal anesthesia in not necessitating hospitalization of the patient; the risk attached to local blocking is practically nil, and is not followed by the undesirable after-effects which so often accompany spinal anesthesia.

Caudal injections give very satisfactory anesthesias for urologic examinations and treatment. The wall of the bladder is completely relaxed and the bladder thus distended. Such relaxation with absence of pain and straining, permits the operator to carry out a thorough, unhurried examination of the bladder and ureters. In none of the patients examined in this manner in the Mayo Clinic have there been undesirable after-effects. The injection may be repeated if necessary. In certain types of cases, such as severe cystitis and pyelonephritis, caudal injections have been given in order to facilitate lavage of the renal pelvis. In one case ten injections were given in seven weeks. The reaction following cystoscopy in severe cases of cystitis is not uncommonly due to voluntary muscle spasm around the cystoscope, especially in the region of the neck of the bladder; this does not occur after sacral anesthesia. In a number of patients with pyelonephritis and severe cystitis who were given periodic renal lavage, treatments were first carried out under caudal anesthesia and later merely with urethral cocainization, the convalescence in these cases was invariably much smoother and easier when caudal anesthesia was used. In several instances, patients refused to submit to cystoscopy without caudal anesthesia.

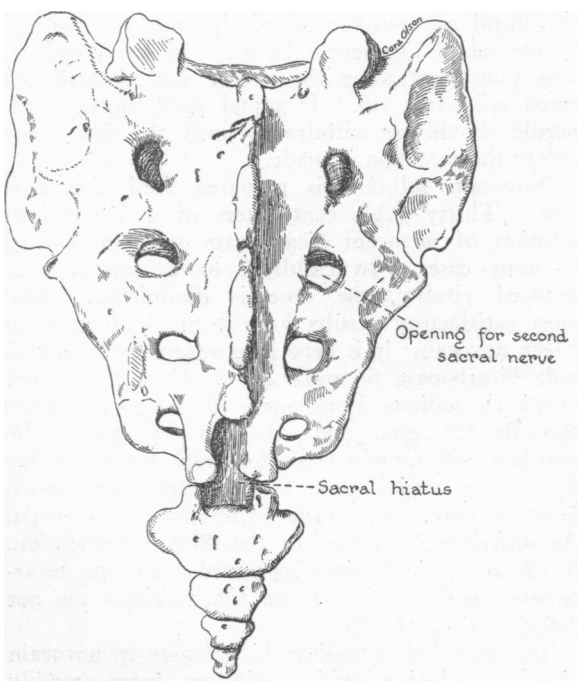

Fig. 2
Relation of sacral foramina and caudal opening to the bony landmarks of the sacrum

TABLE I.
Results of anesthesia

	Cases	Satisfactory	Failures
Introduction of radium needles through perineum into cancerous prostates...	74	69	5
Transvesical treatment of bladder tumors			
Fulguration	20	20	
Radium emanations	16	16	
Urethral operations	15	14	1
Litholopaxy	21	20	1
Manipulation of ureteral stones	31	31	
Prostatic punch	9	9	
Cystoscopic examination—			
Tuberculous cystitis	63	61	2
Malignant cystitis	48	44	4
Alkali phosphate cystitis	6	6	
Cystitis of pyelonephritis	77	70	7
Irritable bladders	10	9	1
Submucous ulcer	2	2	
Impossible to enter caudal foramen			8
	400	373	27

DISCUSSION

Failures result from various causes. In some patients it is impossible to enter the canal; this generally occurs in patients with small sacrums, in those with marked hypertrophic arthritis, or with old traumatically distorted pelves. Traumatic distortions of the sacrum are not uncommonly seen in conjunction with old traumatic urethral strictures. Patients with occult spina bifida often have deformed sacral foramina and even if the canal is entered the anesthesia may be deficient. In certain cases of malignancy of the bladder there is an extension of the growth through the wall of the bladder to outside structures not anesthetized by the sacral nerves. In one case failure resulted from an extension of the growth into the sacrum which blocked the sacral canal. The majority of failures are due to errors in technic, or to poor solutions. Four of the failures in this series occurred on the same day and were due to the use of old powders.

Caudal anesthesia is very satisfactory for the examination of infected bladders. Tuberculous bladders which hold only 20 or 30 c. c. of fluid may be distended sufficiently to permit complete examination with catheterization of the ureters without discomfort to the patient.

In malignant bladders a thorough examination of the growth, with the removal of a specimen for histologic study, may be carried out. The growth may be extensively fulgurated over a long period, or radium may be planted in the growth without the patient being aware of the manipulation.

In the cases of litholopaxy a number of patients had large stones removed which required more than an hour of crushing and washing.

One of the most satisfactory features of caudal anesthesia is its almost complete absence of postoperative sequelae. Several patients complained of

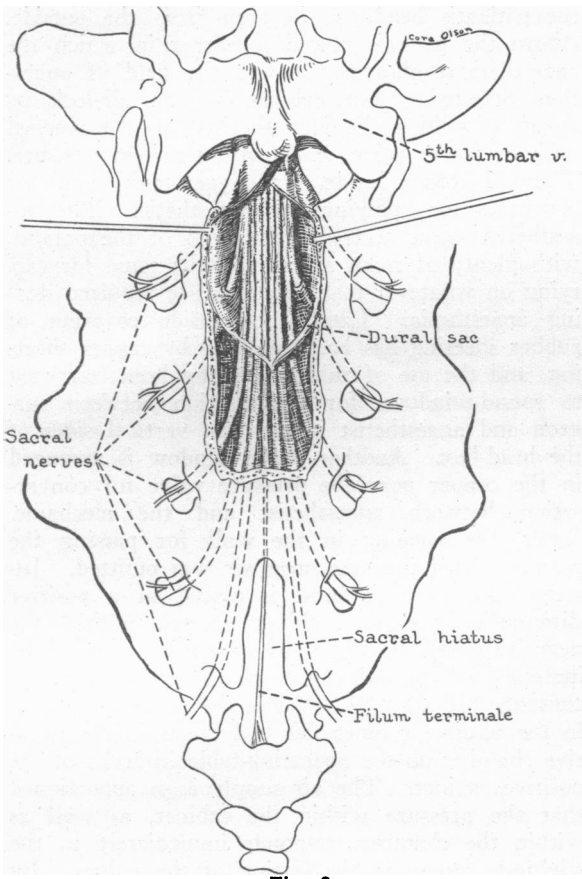

Fig. 3
Showing relation of dural sac to the sacral canal, nerves and sacral ligament

nausea and two lost consciousness for several minutes. One patient developed a definite psychosis following the injection which lasted about thirty minutes. Transient sensations of faintness and forceful and increased heart beat were occasionally seen. In no case were delayed or prolonged after-effects observed, and in none was there indication of paralysis of the anesthetized nerves after the general effects of the anesthesia had receded.

Caudal anesthesia gives an excellent relaxation of the lower ureter, and permits the manipulation of ureteral stone; in some cases several large ureteral catheters may be readily inserted to the site of the stone without causing the patient discomfort. Occasionally there is relaxation of the lower ureteral segment and spasm of the upper ureter which causes an impassable angulation.

Sacral anesthesia is simply and easily carried out. It causes very little discomfort to the patient, gives a satisfactory working anesthesia, and rarely produces undesirable after-effects.

Provisions of Sheppard-Towner Act Rejected by Five States—"During the summer the State of Maine, through the action of Governor Baxter and his Council, and the State of Louisiana, through the action of its Legislature, rejected the provisions of the Sheppard-Towner Act. Thus, five States have made definite rejection of Federal aid offered through that Act. Most of the State Legislatures will meet in January, 1923, and final action will be taken by those bodies on this matter in the States where the Legislatures have not already accepted or rejected the provisions of the Federal maternity and infancy law, through which the national Government offers financial aid to States which will carry out a program approved by a Government board."—A. M. A. Bulletin.

INTRATRACHEAL INSUFFLATION ANAESTHESIA *

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One of the greatest dangers of intrathoracic operations is the occurrence of pneumothorax as soon as the pleural cavity is opened. This, when limited to one side, while not fatal, always causes more or less serious respiratory embarrassment. When both cavities are opened the result is generally fatal. As it not infrequently occurs in operations upon one side of the thorax that the opposite lung is more or less incapacitated as a result of injury or disease, the desirability of avoiding the serious consequences of pneumothorax has long been appreciated.

The word *pneumothorax* was coined in 1803 by Itard, a French physician. The condition it describes barred for practically one hundred years the chest cavity to the knife. Modern thoracic surgery dates from 1896, when Quénu first made known the idea of restoring in pneumothorax artificially by differential air pressure the disturbed equilibrium of the lung, and Tuffier advocated the use of insufflation for the performance without pneumothorax of operations requiring the incision of the pleura. Quénu's apparatus was constructed on the lines of a diver's helmet in which the head of the patient was placed with a sponge saturated in chloroform. The air in the helmet was compressed and the pleural cavity opened. Tuffier introduced a narrow, slightly curved copper tube into the larynx and trachea. Matas of New Orleans was the first in the United States to become interested in thoracic surgery. He introduced the *Feel-O-Dwyer* type of apparatus for artificial respiration. The anaesthetic was given by means of a funnel attached to a T-tube. The main tube was introduced into the larynx and trachea. In 1898 Parham of New Orleans used the Matas apparatus in performing a resection for tumor of the bony wall of the chest—the first thoracic operation of record in this country. In 1903 the Sauerbruch cabinet was invented; and 1904 marks the real beginning of thoracic surgery by the transpleural route. For its performance Sauerbruch had built a chamber of about five hundred cubic feet contents, constructed of iron and glass, inside of which the operation is performed. Over the opened pleural cavity the air pressure is reduced below atmospheric pressure, while the patient, whose head is passed through an opening in the wall, breathes in atmospheric pressure. In quick succession, chambers were built in Berlin, Cologne, Vienna, St. Petersburg, and other places in Europe. Size of the chambers averages about six hundred cubic feet contents; the largest one at Vienna contains about 750 cubic feet. Their height is usually seven feet six inches.

The reverse proposition was also taken up by Sauerbruch, and after him Peterson, and Engelken constructed positive differential pressure cabinets, Peterson of wood and Engelken of iron and glass,

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